ARTICLE 6
PROCEDURES FOR BRACED FRAMES

6.0 INTRODUCTION

Braced frames develop their resistance to lateral forces by the bracing action of diagonal members. The braces induce forces in the associated beams and columns so that all work together like a truss with all members subjected to stresses that are primarily axial.

A **CONCENTRICALLY BRACED FRAME** has minor eccentricities in the joints of the frame that are accounted for in the design.

An **ECCENTRICALLY BRACED FRAME** has elements that are strictly controlled to combine a stiffening effect due to the diagonal braces with yielding in the link beams. Eccentrically braced frames are present only in conforming buildings.

6.1 CONCENTRICALLY BRACED FRAMES

6.1.1 STRESS CHECK: The building satisfies the Quick Check of the stress in the diagonals.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. Calculate the average axial stress in the diagonals using the procedures of Sec. 2.4.7.4. Increase the calculated stress to account for torsion, based upon the amount of torsion (Section 3.3.6) present and the distance between braced frames. If the average stress exceeds 30 ksi, an accurate analysis of the stresses on the bracing elements shall be performed.

6.1.2 STIFFNESS OF DIAGONALS: All diagonal elements required to carry compression have Kl/r ratios less than 120.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the stiffness of the diagonals. Check the bracing elements, amplifying the seismic force by the factor 1.25.

6.1.3 TENSION-ONLY BRACES: Tension-only braces are not used as the primary diagonal bracing elements in structures over two stories in height.

The deficiency is in the strength of the braces. Check the braces. If they are tension -only, and the building is over two stories in height, place the building in SPC 1. Tension-only bracing of small penthouse structures may be reviewed using the procedures in Section 2.4.6. Conforming buildings which fail this check shall be placed in SPC 4.

6.1.4 CHEVRON BRACING: The bracing system does not include chevron-, V-, or K- braced bays.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. Check all elements in the braced frames. For Chevron and V-braced frames, the beam shall be a single element that can carry the gravity loads without the intermediate support of the braces. Check the adequacy of the beam for the seismic forces amplified by $C_d/2$, but not less than 1.5. Consider the effect of buckling of a leg of chevron-bracing or V-bracing, including the continuity, strength, and bracing of the beams and the ability of the connection to permit buckling of the brace while not destroying the capacity for repeated cycles of loading. If K-bracing is used in buildings over two stories, amplify the seismic forces in the bracing and columns by the factor $C_d/2$, but not less than 1.5.

6.1.5 CONCENTRIC JOINTS: All the diagonal braces frame into the beam-column joints concentrically.
For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the joints. Evaluate the consequence of the eccentricity on the member required to resist it. Evaluate the shear, bending, and axial force requirements at the locations of eccentricities.

6.1.6 CONNECTION STRENGTH: All the brace connections are able to develop the yield capacity of the diagonals.
The deficiency is in the strength of the connections. Check the connection strength. Use a demand value that develops the tensile capacity of the brace or is 1.25 times the required seismic force. If connections in a conforming buildings cannot develop the yield capacity of the brace and do not meet the requirements of Part 2, Title 24, Section 2211A.9.3, the building shall be placed in SPC 4.

6.1.7 COLUMN SPLICES: All column splice details of the braced frames can develop the column yield capacity.
The deficiency is in the strength of the splice. Calculate the adequacy of the splice connection for all expected forces including gravity loads. Amplify the seismic load for partial penetration welded splices by the factor $C_d/2$ when the seismic load produces tension at the splice. If the column splice details in a conforming buildings cannot develop the yield capacity of the column and do not meet the requirements of Part 2, Title 24, Section 2211A.9.5, the building shall be placed in SPC 4.

6.1.8 CONCRETE BRACED FRAMES: None of the braces in the framing system are of reinforced concrete construction.
The deficiency is in the ductility of the braced frame. Report this condition as a deficiency, and place nonconforming buildings in SPC 1. Place conforming buildings in SPC 4.

6.2 ECCENTRICALLY BRACED FRAMES

6.2.1 LINK BEAM LOCATION: The link beams are not connected to the columns.
The deficiency is in the ductility of the link beam-column connection. Report this condition, and place the building in SPC 4.